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AUTHOR Fortney, Virginia
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ABSTRACT

Biomechanical analysis of human movement seeks to relate observable motions or configurations of the body to the forces that act to produce those motions or maintain those configurations. These are identified as force-motion relationships. In assessing force-motion relationships in children's movement, the process type assessment, Ohio State University Scale of Intra-Gross Motor Assessment (O.S.U. SIGMA), is used to assess a child's developmental performance on 11 select gross motor skills. The 11 motor skills--walking, catching, ladder climbing, stair climbing, throwing, striking, skipping, running, hopping, jumping, and kicking--were tested for reliability and classified into three groups. Each skill is described in four levels of development. The practitioner can set an informal environment and assess the child's developmental level by observing the child at play or work. The instrument is suitable for use with preschool and primary level children as well as intermediate level school children without previous instructional programs in physical education or with delayed development. It places gross motor skills on a continuum and, therefore, children can be assessed on a regular basis as an on-going part of the curriculum. (JMF)

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New Directions in Assessment: Biomechanical Development

Virginia Fortney

Pennsylvania State University

Department of Physical Education for Women

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New Directions in Assessment: Biomechanical Development

As you know, biomechanics is a discipline concerned with the application and extension of mechanics to the analysis of biological systems. In biomechanical analysis of human movement, we seek to relate observable motions or configurations of the body to the forces which must be acting to produce those motions or maintain those configurations (Andrews, 1974). These are identified as force-motion relationships.

In considering force-motion relationships the idea of assessing the products and the processes of movement comes to mind.

In the past practitioners in assessing children's movement frequently measured the products of force-motion relationships. By product it is meant: how far, how fast, how many. In detail those querries become: How far can Vanessa throw? How fast can David run? How many catches in a row can he make?

More recently practitioners have become interested in the processes of force-motion relationships. To analyze children's movement by assessing the processes of these relationships, the questions about movement become: Does Vanessa step with the leg on the same side as the throwing arm? Where are David's hands in relation to his body during the run? Does he use hands and arms bent at the elbows to scoop the ball into the body?

In a speech about games and children Edward C. Devereux of Cornell University emphasized that in games what the child is doing to the ball is not as important as what the ball is doing to the child (Devereux, 1972). This thought of Devereux's suggests that what is happening within the child (process) in games and movement is important. In assessing force-motion relationships in children's movement it becomes obvious that in order to learn the most about an individual's motor development that the process

type assessment is the route to go.

One assessment instrument which I would like to discuss today was developed by Edwin Michael Loovis during his doctoral study at The Ohio State University and is called the O.S.U. SIGMA. It is an instrument used in assessing a child's developmental performance on 11 select gross motor skills.

Other individuals who are developing materials and assessment instruments along this line are Vern Seefeldt at Michigan State University and Karen DeOreo at Kent State University.

The O.S.U. SIGMA, SIGMA stands for Scale of Intra-Gross Motor Assessment, is a developmentally designed instrument. A test-retest reliability study of the O.S.U. SIGMA was designed and implemented by Loovis. Thirteen judges viewed and rated the video taped performances of 12 normal children, ages 2½ to 14 years, who had been previously administered the O.S.U. SIGMA. The reliability study was conducted with one week separating the test and retest observations of the identical video tape. The data were analyzed with Scott's Pi.

Pi coefficients for inter-judge and intra-judge test reliability for each of the 11 skills were classified into three groups. Walking, catching, ladder climbing, and stair climbing each had a median Pi reliability coefficient of .83 or higher; this group of skills was identified as having high reliability. The group with medium reliability coefficients, .54 or higher included throwing, striking, and skipping. The group with low reliability coefficients, .53 or lower, included running, hopping, jumping, and kicking.

In summary then, the high reliability group of walking, catching, ladder climbing, and stair climbing had reliability coefficients within the range of acceptability, .83 or higher. The medium and low reliability groups containing seven gross motor skills produced reliability coefficients

lower than conventional standards.

Each gross motor skill in the O.S.U. SIGMA is described in four levels: Level I, II, III, IV, with Level IV containing the mechanical elements of a mature pattern. Each skill is desribed on a single page with the columns containing the descriptions of the four levels. On the upper part of the page the test equipment and test conditions are described. On the lower part of the page the performance characteristics or force-motion relationships are described and the number of trials is given. The gross motor skill of stair climbing in the O.S.U. SIGMA may be seen in Figure 1 (Loovis, 1976).

Insert Figure 1 about here.

To assess a child's developmental level in stair climbing the practitioner would set the environment and either observe the child in play or work with the child in a testing manner. In stair climbing you will see that both David and Vanessa, ages 4½ and 5 years respectively, would be in developmental Level IV. They both, using alternate stepping pattern, walk up and down five steps totally unassisted in three trials. The other 10 gross motor skills in the O.S.U. SIGMA can be assessed in a similar way.

The level idea of development of a gross motor skill is supported in a recent study by Mary Ann Roberton. She indicated that stage (levels) theory in motor development predicts that human movement changes over time in an immutable stage sequence (Roberton, 1976).

The O.S.U. SIGMA is suitable for use with preschool children and primary level school children. In cases of delayed development or lack of a previous instructional program in physical education it could also

O.S.U. SIGMA

SKILL OF Stair Climbing

TEST EQUIPMENT: Series of Stairs

	LEVEL I	LEVEL II	LEVEL III	LEVEL IV
TEST CONDITION	When positioned at the bottom of a series of steps, Note:	When standing at the bottom of a series of steps, Examiner cannot serve as an	Same aid in place of	Same railing or wall.....
PERFORMANCE	The child demonstrates <u>one</u> of the following behaviors: a. creeps up 5 steps and slides down from step to step on the buttock, b. creeps up and down 5 steps, c. walks up and back down while in a hands-feet position like animal walking.	The child, with or without the aid of the railing or wall, walks up and down 5 steps and demonstrates the following behaviors in two out of three trials: a. walks up using a two-foot landing (mark-time pattern), b. walks down either in the same manner or by sliding from step to step on the buttock.	The child, with the aid of the railing or wall, walks walks up and down 5 steps and demonstrates the following behaviors in two out of three trials: a. walks up ussing an alternate stepping pattern, b. walks down in the same manner or by using a two foot landing (mark-time pattern).	The child independently walks up and down 5 steps and demonstrates the following behaviors in two out of three trials: a. walks up using an alternate stepping pattern, b. walks down using an alternate stepping pattern.

Figure 1. O.S.U. SIGMA, Stair Climbing Gross Motor Skill

be used to assess the developmental status of intermediate level school children.

Bronfenbrenner is critical of data which we, in all disciplines, have of children. He suggests that what data we do have may or may not be valid because the children were assessed by strange adults, investigators, in strange environments, laboratories (Bronfenbrenner, 1974). We as practioners can begin assessing children in their natural play environments and/or in the gymnasia. This type of assessment can serve as an aid to instruction and to help teachers and parents understand the individual child's needs.

The O.S.U. SIGMA places gross motor skills on a continuum and therefore you could assess children on a regular basis as an on going part of your curriculum. It can be used in real life on the playground or in the gymnasium, informally or formally. If you like and have the equipment and man power the performance could be recorded on video tape and then evaluated.

The O.S.U. SIGMA is not perfect but it is an excellent start. It is inexpensive to administer. And at the moment it is useable.

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